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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/593,809

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Jagdish Narayan

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EXAMINER

LANGMAN, JONATHAN C

ART UNIT

PAPER NUMBER

1794

MAIL DATE

DELIVERY MODE

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/593,809	Applicant(s) NARAYAN ET AL.	
	Examiner JONATHAN C. LANGMAN	Art Unit 1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 May 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) 5-23 and 25-28 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>9/20/2006</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Applicant's election with traverse of claims 1-4 and 24 in the reply filed on May 1, 2009 is acknowledged. The traversal is on the grounds that the office has not shown that there is any burden in searching groups I-III. These arguments have been considered, but are not found persuasive. There is no requirement in PCT 13.1 and 13.2 of a burden in searching the entire claims to establish a prima facie case of a lack of unity. Applicants have made no argument that the cited references do not disclose the special technical feature or that the asserted feature is not a special technical feature.

For reasons of record the Examiner has shown a lack of unity between Groups I, II, and III. The applicant has not persuasively argued against this lack of unity and thus the requirement is still deemed proper and is therefore made FINAL.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4 are rejected under 35 U.S.C. 102(b) as being anticipated by Zhang et al. ("Formation of Low Resistivity Alpha Ta by Ion Sputtering").

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Regarding claims 1-3, Zhang teaches a tantalum film used in semiconductor industry (pg 237, col. 1, 1st pp.). Zhang teaches that the tantalum film is alpha tantalum (pg 237, col. 2, 1st pp. of Results and Discussion). As seen in Figure 3, the film has a broad x ray diffraction peak at $2\theta=38^\circ$. Furthermore, as seen in Figure 5, the grain size is 12.5 nms and has a resistivity of 32.5 microhm-cm for a tantalum film with a thickness of 10 nms.

Although Zhang is silent to the tantalum film having continuous electron diffraction rings, this characteristic is intrinsic to nanocrystalline alpha tantalum films, as taught by Zhang. Since the prior art teaches the same material as instantly claimed, it is inherent and expected that the prior art film will have continuous electron diffraction rings, as instantly claimed.

It has been held that where the claimed and prior art products are identical or substantially identical in structure or are produced by identical or a substantially identical processes, a *prima facie* case of either anticipation or obviousness will be considered to have been established over functional limitations that stem from the claimed structure. *In re Best*, 195 USPQ 430, 433 (CCPA 1977), *In re Spada*, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). The ***prima facie*** case can be rebutted by evidence showing that the prior art products do not necessarily possess the characteristics of the claimed products. *In re Best*, 195 USPQ 430, 433 (CCPA 1977). In regards to claim 4, the prior art is silent to the net diffusion distance properties of the tantalum film. However, since the tantalum film as taught by Zhang is the same

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structure as instantly claimed, it is expected that the tantalum film of Zhang will behave in the same manner as instantly claimed. See *in re Best* case law applied above.

Claims 1-4 and 24 are rejected under 35 U.S.C. 102(a) as being anticipated by Yuan et al. ("A New Method for Deposition of Cubic Ta Diffusion Barrier for Cu Metallization").

Yuan et al. teach alpha tantalum films deposited on Si substrates to reduce copper metallization from diffusing into the copper substrate (Title, and Introduction section).

Yuan et al. teach that the Tantalum diffusion barrier comprises alpha tantalum, a broad diffraction peak at 38° , and a nanocrystalline microstructure (Table 1, Figure1, and pg 127).

Although Yuan is silent to the tantalum film having continuous electron diffraction rings, this characteristic is intrinsic to nanocrystalline alpha tantalum films, as taught by Yuan. Since the prior art teaches the same material as instantly claimed it is inherent and expected that the prior art film will have continuous electron diffraction rings as instantly claimed.

It has been held that where the claimed and prior art products are identical or substantially identical in structure or are produced by identical or a substantially identical processes, a prima facie case of either anticipation or obviousness will be considered to have been established over functional limitations that stem from the claimed structure. *In re Best*, 195 USPQ 430, 433 (CCPA 1977), *In re Spada*, 15

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USPQ2d 1655, 1658 (Fed. Cir. 1990). The ***prima facie*** case can be rebutted by evidence showing that the prior art products do not necessarily possess the characteristics of the claimed products. *In re Best*, 195 USPQ 430, 433 (CCPA 1977). In regards to claim 4, the prior art is silent to the net diffusion distance properties of the tantalum film. However, since the tantalum film as taught by Yuan is the same structure as instantly claimed, it is expected that the tantalum film of Yuan will behave in the same manner as instantly claimed. See *in re Best* case law applied above.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al. ("Formation of Low Resistivity Alpha Ta by Ion Sputtering") as applied to claims 1-4 above, in view of Chen et al. ("Phase Formation behavior and Diffusion Barrier Property of Reactively Sputtered Tantalum Based Thin Films used in Semiconductor Metallization").

Zhang teaches a nanocrystalline alpha tantalum film used in semiconductor industry. Zhang is silent to the specific structure of Si/Ta/Cu, as applied above. However, Zhang in the introduction section teaches that Tantalum films are known in the art and described by Chen et al.

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Chen et al. teaches in their introduction section, that tantalum films are used as diffusion barriers when placed between copper and silicon substrates.

It would have been obvious to a person having ordinary skill in the art at the time the present invention was made to use the tantalum films of Zhang as diffusion barriers for copper and silicon substrates in the semiconductor industry as is known in the art. Combining prior art elements according to known methods to yield predictable results is sufficient enough to establish a *prima facie* case obviousness ((MPEP 2141 [R-6], KSR International Co. v. Teleflex Inc. (KSR), 550 U.S. ___, 82 USPQ2d 1385 (2007)). Semiconductor devices utilizing tantalum films as diffusion barriers are known structures in the art and would have been an obvious structure to apply to the tantalum films of Zhang.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The X references cited in the International Search Report are considered cumulative to the rejections applied above.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JONATHAN C. LANGMAN whose telephone number is (571)272-4811. The examiner can normally be reached on Mon-Thurs 8:00 am - 6:30 pm EST.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on 571-272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JCL

/Timothy M. Speer/
Primary Examiner
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